

An Empirical Study of Lead Toxicity in Cosmetics

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ABSTRACT

Lead is a heavy metal and a ubiquitous neurotoxin linked with learning and behavioural disorders. Lead exposure can cause learning, language and behavioural problems such as reduced IQ, impetuosity, extended aggression, lowered academic performance, anaemia, and with long exposure result in kidney failure. Lead is also associated with miscarriage, infertility in both sexes, changes in hormones, irregular menstruation and delays in the onset of puberty in girls. Toxicity of heavy metals to the animals and humans is the end result of long-time low level or excessive degree exposure to constituents frequent in our surrounding. Apart from these, different customer items like beauty care products and toiletries have been expressed as a source of heavy metal exposure to human creatures. The cosmetics had been digested and analysed for the lead with the usage of flame atomic absorption spectrophotometer. This study aims to evaluate the lead quantity in the most frequently used topical cosmetic products (lipsticks, fairness creams, lip balms, face powder and foundation).

KEYWORDS: Lipstick, Cosmetic products, Lead, Heavy metals, Health risks

The FDA has recommended that the maximum level for lead as an impurity in lip products and topical beauty care products is 10 ppm that would not pose any threat to human health. The guidance is applicable to lip products such as liners, glosses, and lipsticks and topically applied cosmetics (e.g. blushes, shampoos, body lotions and eye shadows). The guidance is inapplicable to externally applied products, classified as drugs or to hair dyes.

The constituents present in cosmetic products either synthetic or natural may cause irritation, photoreactions, sensitization and hypersensitivity to the skin. In this modern lifestyle, cosmetic products are major component and hence in great demand. A few of the heavy metals are water soluble and thus can be promptly ingested through skin even when applied externally as cosmetics.

The constituents present in lipsticks are oils, antioxidant materials, emollients, TiO₂, silica, mica and colourants to provide different types of properties, colours and appearance to them. These were used since the ancient era and the pioneers were women of Philippines. Lipsticks are classified into satin and sheer, moisturising, frosted, matte, creamy, long lasting and shimmery wearing lipsticks. One of the characteristic features of lipsticks is the diverse colours that is obtained by adding pigments, such as mineral or organic or may because of heavy metals.

The dyes frequently used in lipsticks are metal-based colours consisting of Pb. Due to its day by day utilization as face makeup, these cosmetics, the amount of heavy metals in cosmetic products has become a health issue of international level. The metallic gadgets used amid the manufacturing process of lipsticks also attributes the presence of heavy metals in lipsticks. Lead may occur as an impurity in any of the cosmetic products due to its natural presence in the surrounding such as air, water etc. Cosmetics manufacturers having tendency to avoid the potential harmful levels of lead in their cosmetics. Through reasonable and practical approaches to control raw material and through other good manufacturing products the low levels of lead in cosmetics could be achieved.

It is mandatory to know the quantity and types of constituents present in the cosmetics to analyse their potential hazard due to presence of heavy metals. Study shows that lead in lipsticks is unnecessary and can be avoided.

FDA regulates cosmetics under several sections to ensure safety of the cosmetic products and if it is in compliance with the act. These acts regulate and provide responsibility to manufacturer or distributor for the safety insurance of cosmetics and also may take legal actions if cosmetic products are adulterated, misbranded or contaminated with toxic level of heavy metals possessing potential threat to human health.

There is a high popularity of cosmetic products due to the extended pursuit of beauty irrespective of the literacy, age or gender of people. This study aims to determine the quantity and associated health risks in humans with lead toxicity due to presence of Pb in most of the cosmetic products.

MATERIAL REQUIREMENTS

1. Lipsticks
2. Fairness Creams
3. Lip Balms
4. Anti-ageing creams
5. Atomic Absorption Spectrometer equipped with Flame and Flameless Techniques
6. 10% nitric acid
7. Hydrofluoric acid
8. Glassware
9. Perchloric acid
10. ICP-MS

REVIEW OF LITERATURE

The study published in Contact Dermatitis shows that eighty-eight eye shadow colours from forty-nine different products seventy-five percentage of the eye shadow consist more than five parts per million of Pb, Ni, Cr, Co, and As and 100% contained more than 1 ppm of the substances mentioned above.

The study reported that sixty-one percentage of the thirty-three lipstick brands consist Pb upto the level of 0.65 ppm and no where it has been listed as an ingredient. The lead was present in all of the samples of different lipstick brands ranging from 0.09 to 3.06 parts per million.[9].

The study on lipsticks proposed that 81 percentage of samples of lipstick had lead in them ranges from 0.079 to 0.84 ppm, and one among them consist of 6.3 ppm.[2]. As intentional ingredients in cosmetic products many metals are banned in Canada, but some of these are regulated as product impurities since their presence is considered not avoidable.[3].

The study “Exposure Add Up” revealed that the average women on daily basis use twelve products that consist a total of one hundred sixty-eight unique ingredients. It reported that everyday use of these products resulting 1 in 13 women are exposed to probable human carcinogenic ingredients and 1 in 24 are exposed to ingredients known as reproductive and developmental toxins causing infertility or reduced development for a child or a baby inside the mother body.[18]

A study analysed fifteen kind of different samples such as perfumes, cream, lotion, deodorants, etc. for the presence of 7 types of phthalates and 4 types of parabens and reported that among 15 samples only 1 was free from the presence of phthalates and parabens. Among other 14 samples at least three or more of these are present, and the level ranges from 1.22 – 5289 ppm.[19].

WHO reported that presence of Hg in soaps and skin whitening creams is a potential danger causing anxiety, nerve damage, depression, numbness, seizures, reduces immunity of skin to infections and also memory loss serious side effects and can be fatal.[17].

California researchers proposed that 32 samples of tested lip products consist of high amount of Ti and Al, detectable manganese. The presence of lead in the tested sample is attributed as 75% of all the samples tested. Among these 47% of the samples contain higher concentrations of lead than the referred maximum level of 0.1 parts per million through FDA.[23].

A study conducted on the skin whitening cream has reported that in most of the skin lightening cream mercury is used as an ingredient. It is a potent neurotoxin, and referred by different names such as Hg₂Cl₂ mercurous chloride, mercuric, mineral calomel, or mercury. This study reported that prolonged use of mercuric cosmetic products causes swelling of the kidneys, liver and urinary tract. The Hg compounds have tendency to accumulate in the body and can readily absorbed through skin on the surface application.[20]

The study published in PerkinElmer, conducted by Zoe Grosser, Lee Davidowski, Laura Thompson reported that small amount of hydrofluoric acid is used to provide better consistency while sample preparation. The importance of HF in digestion process is also discussed by FDA. They have purchased different variety of lipsticks ranging from black to pink, purple, red and brown, nail polishes and skin creams and made their duplicate and tested after digestion for the presence of heavy metals.[10].

The lead has been detected among 12 lipsticks ranging from 1.38 to 0.0407µg/g and the precision and agreement among the purchased and duplicate samples were found to be 0.027µg/g. The lead was detected the tested skin cream in the level range of 0.187- 0.168 µg/g and in tested nail polish colour ranged from blue to pink and red, the range of lead detected was found to be 6.03 – 0.204 µg/g. [10].

The study conducted on thirty lipsticks, eight lip – balms and three anti-ageing creams available in Delhi market for the presence of Pb, chromium, Cd and Ni and thirty-two samples of fairness creams: 6 used by men and 26 made for women tested for the presence of Hg. This study

reported that in 50% of samples chromium was detected within range of 0.45 ppm – 17.83 ppm. And 43.3% of samples i.e. 13 out of 30 nickel was detected within the range of 0.57 ppm – 9.18 ppm and Pb and Cd were not found in the collected samples of lip – balm and creams used as anti-ageing. In 44% samples i.e. 14 of 32 mercury was detected in the level range of 0.10 ppm – 1.97 ppm. No heavy metals have been identified in the balms used for lip and creams used against ageing.[11].

The study conducted the test on 20 commercially available lipsticks in US market for the presence of lead in between 2007 to 2009, and applied same methodology to test more lipstick samples in 2010 and 30 more samples in 2012 and reported that the level of lead ranges from 0.026 ppm – 7.19 parts per million (only in one lipstick), the average concentration of lead was found to be 1.09 ppm.[24].

The lead level was found to be ranges from 0.0084 parts per million to maximum of fourteen parts per million (in one blush and eye shadow) for the externally applied cosmetics easily available in U.S. market.[17].

CONCLUSION

Vast ingredients such as fats and silica-based components are present in cosmetic products and to digest them for better consistency addition of small amount of hydrofluoric acid is necessary.

To detect low concentrations of analytes the use of ICP-MS is a better choice for evaluating the potential toxic constituents present in cosmetics. DRC can be used for interference correction such as molecular interferences to allow the lowest detection limit of analytes (heavy metals) present in cosmetic products.

The application of ICP-MS and DRC is successful for analysing toxic elements present in three types of cosmetics namely lipsticks, lip-balm, anti-ageing creams and have shown fine results through spiked and duplicate samples. Analysis of reference sample is needed to ensure that digestion and instrumental analysis were correct and in the control of experimenter. The technique of flame atomic absorption spectroscopy allows the quantification of heavy metals in cosmetics such as lipsticks and powders and in some cosmetics detection level of lead is higher than the level prohibited by European regulation.

The overall results signified that cosmetic products with high level of lead and other heavy metals can be harmful to human health as these metals can be accumulated in the body. This study representing that the cosmetic products contaminated with heavy metals even used topically are should be of high concern and safer limits for concentration of metal should be regulated and considered through manufacturer and distributor.

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